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ABSTRACT

This report reviews recent research on the effects of changes in school environments on economically disadvantaged, minority group students, discusses methodological problems encountered in such research, and describes a longitudinal study designed to determine how pupil relocation policies might be used to improve academic achievement of black students. It was found that: (1) increases in classroom mean achievement levels have a positive impact on black students' academic growth patterns; (2) students originating in predominantly black sending classrooms benefit academically from moves into majority white classrooms; (3) the optimal type of move for a black student originating in a predominantly black classroom is one in which the receiving classroom is between fifty and ninety-five percent black and reflects a higher academic performance level than the sending classroom; (4) relatively high achieving students experience greater achievement gains in their receiving schools than in their sending schools, whereas low achievers tend to show academic losses in their receiving schools; and (5) changes in pupil/classroom ratios and level of teahcer education and experience are not strongly related to academic growth rate of black students. Limitations of the current research are discussed and implications for pupil assignment strategies are outlined. (Author/JCD)

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THE EFFECTS OF CHANGING SCHOOL ENVIRONMENTS

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Final Report
Submitted to the
National Institute of Education

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Chapter 1

INTRODUCTION

During the past quarter century, increased concern with minority education has yielded many significant changes. Advocates and opponents of school desegregation have engaged in many hard-fought battles, massive funds have been allocated for compensatory education programs, and countless innovations aimed at enhancing the quality of minority education have been implemented. However, perhaps the most serious problem associated with the education of minority students has resisted solution. A strong link still exists between students' social origins and their academic performance, and little progress has been made toward the development of strategies to ameliorate this situation. The purpose of this research is to contribute to the formulation of educational policies aimed at reducing the cognitive inequalities between social groups through raising the level of black academic achievement.

One reason to be acutely concerned with the academic performance gap that exists between racial groups arises from the increased attention which is currently being given to students' levels of basic skills. A back-to-basics movement, which has gained impetus from the widely publicized decline in standardized test scores as well as the public's growing perception that high school graduates are not equipped with the basic skills necessary to function effectively in society, has become a dominant force in American education. Probably the most significant manifestation of this movement has been the advent of minimum competency testing. Already two-thirds of the states have mandated some form of competency testing, and the remaining states have legislation pending or feasibility studies in progress. As the results of these

studies are reported, a dismal pattern is materializing -- minority students are failing in disproportionate numbers. In Florida, for example, 77% of black high school juniors failed the mathematics section of the competency exam administered in October of 1977 compared to a failure rate of only 24% for white juniors. Black students fared a little better in 1978, however a large gap in mathematical skills was still evident -- the failure rate was 60% for black 11th graders compared to only 17% for white 11th graders (New York Times, 11 January 1979).

Another cause to focus attention on the difference in academic performance levels across social populations stems from a belief that the persistent presence of a substantial black/white achievement gap reflects a lack of access to equal educational opportunities for minority students. One possible definition of equality of educational opportunity focuses narrowly on the extent to which school resources are distributed equally among all students. However, this definition can be challenged by taking the point of view that the American system of public education is responsible for creating change in students. The basic argument against defining equality of educational opportunity exclusively in terms of equal inputs to different schools is that children enter public schools with a large discrepancy in abilities due to individual backgrounds, and that exposure to equal school resources may merely serve to perpetuate these initial differences.

Initial impetus for the movement away from the sole consideration of school inputs in determining the availability of educational equality was supplied by the Supreme Court's rejection of the "separate but equal" doctrine in Brown v. Board of Education. The Court's decision in this landmark school desegregation case introduced the

notion that attention must be given to the effects of schools when assessing educational equity:

> To separate them from others of similar ages and qualifications solely because of their race generates a feeling of inferiority as to their status in the community that may affect their hearts and minds in such a way unlikely ever to be undone.

Although some consideration of the influences that schools exert on students surfaced in Brown, this line of reasoning was quickly overshadowed by the decision's declaration that racial segregation in the schools was inherently unconstitutional. Nevertheless, the foundation for a new concept of equality of educational opportunity had been created -- a concept which would emerge from obscurity a decade later.

In 1964, James Coleman and a group of associates were commissioned to conduct a study pursuant to Section 402 of the Civil Rights Act passed earlier that year:

> Sec. 402. The Commissioner shall conduct a survey and make a report to the President and Congress, within two years of the enactment of this title, concerning the lack of availability of equal educational opportunities for individuals by reason of race, color, religion, or natural origin in public educational institutions at all levels in the United States...

The ensuing report, entitled Equality of Educational Opportunity, (Coleman, Campbell, Hobson, McPartland, Mood, Weinfield, and York, 1966), resurrected the notion that educational equality should mean more than equal access to school resources. This is apparent in that the study extended far beyond an analysis of the distribution of inputs to schools, its primary focus being on the nature of the relationships between school environments and pupil outcomes. In drawing a distinction between input equality and output equality, Coleman (1968) posited three definitions of input equality and two of output equality:

1. One type of inequality may be defined in terms of the differences of the community's input to the school, such as per-pupil expenditure, school plants, libraries, quality of teachers, and other similar quantities.

2. A second type of inequality may be defined in terms of the racial composition of the school, following the Supreme Court's decision that segregated schooling is inherently unequal.

3. A third type of inequality would include various intangible characteristics of the school as well as the factors directly traceable to the community inputs to the school. These intangibles are such things as teacher morale, teachers' expectations of students, level of interest in learning, or others.

4. A fourth type of inequality may be defined in terms of consequences of the school for individuals with equal backgrounds and abilities.

5. A fifth type of inequality may be defined in terms of consequences of the school for individuals of unequal backgrounds and abilities...Such a definition taken in the extreme would imply that educational equality is reached only when the results of schooling (achievement and attitudes) are the same for the racial and religious minorities as for the dominant group. (pp. 16-17)

To be sure, the elimination of the type of inequality described in Coleman's fifth definition represents the ideal. However, the wide disparities in students' home backgrounds and initial performance levels across social populations pose severe challenges to the feasibility of ever totally achieving this ideal. With an acceptance of this reality, Coleman (1968) finally settles upon a concept of equality of educational opportunity which is based on the notion that schools' effects must be large relative to the influences of family backgrounds:

> The relative intensity of the convergent school influences and the divergent out-of-school influences determines the effectiveness of the educational system in providing equality of educational opportunity. In this perspective, complete equality of opportunity can be reached only if all the divergent out-of-school influences vanish, a condition that would arise only in the advent of boarding schools; given the existing divergent influences, equality of opportunity can only be approached and never fully

> reached. The concept becomes one of degree of proximity to equality of opportunity. This proximity is determined, then, not merely by the equality of educational inputs, but by the intensity of the school's influences relative to the external divergent influences. That is, equality of output is not so much determined by equality of the resource inputs, but by the power of these resources in bringing about achievement. (pp. 23-24)

Explicit in Coleman's refined concept of equality of educational opportunity is the idea that educational effects must exist with enough intensity to facilitate a convergence between the performance levels of different social populations of students. It follows that accomplishment of this type of educational equality is contingent upon the ability of schools to exert a strong independent influence on students.

Acceptance of Coleman's conception suggests that discovering the nature of school effects should be an area of major concern for educational policymakers. Using Coleman's ideas about educational equity as a point of departure, this research examines the impact on academic achievement of changes in the levels of a select set of purchasable school resources and changes in the social composition of students' peer groups. Among the set of purchasable school resources examined in this study are such things as class size, teacher experience, and teacher educational level -- resources which can be allocated by relatively high level school administrators. Specifically, this study examines a sample of black students in the St. Louis Public Elementary Schools who were transferred from one school to another as the result of policy decisions, and for this group of students, changes in academic growth rates are associated with changes in the characteristics of educational environments between the sending and receiving schools.

At this time, research on school effects is still in its infancy.

Only fourteen years have elapsed since the publication of the Coleman study, and enormous methodological obstacles have had to be discovered and then overcome to enable advances to be made in the field. The data which form the basis of this particular study allow for the implementation of a research design which represents several methodological advances. Specifically, previous difficulties in separating school effects from individual background effects and problems linked to an absence of pupil-specific data are minimized in this research. Another major problem in much of the previous research is that the effects of changing school environments had to be estimated with statistical procedures rather than observed directly. In this study, the longitudinal nature of the data and the special sample permit the direct investigation of the academic effects that result from changes in educational environments. Given these methodological improvements, this research can inform educational policymakers as to the relative effectiveness of different intervention strategies concerned with eliminating the present level of cognitive inequality which exists among different social populations of students.

Currently, the transfer of students from one school to another is a common occurrence in urban school systems. This situation can be traced to various factors such as legal decisions related to school desegregation, voluntary desegregation programs, school utilization problems, and the manipulation of attendance areas to accomodate changing residential patterns. Given this state of affairs, this research attempts to identify certain pupil relocation policies which might be used to improve the academic performance of black students.

The report is structured in the following manner. Chapter Two contains an overview of the findings of previous school effects

research as well as a discussion of the major methodological problems associated with this genre of research. The purpose of the second chapter is to provide a context within which this particular study can be placed. Chapter Three describes the statistical method and data utilized in this study. In this chapter, special attention is given to the methodological improvements that differentiate this research from earlier studies. Chapter Four is a presentation of empirical findings, which examines the magnitude of the relationships between changes in specific characteristics of school environments and changes in students' rate of academic growth. Chapter Five summarizes the findings of this study as well as identifying its limitations. In addition, this last chapter contains some policy recommendations and suggests possible directions for future studies of school effects.

Chapter 2

REVIEW OF THE LITERATURE

Two basic methodologies have been utilized by researchers concerned with determining the effects of specific characteristics of school environments on student outcomes. The first is borrowed from the economic theory of production, and is commonly termed the input-output approach. Adherents to this analytical framework utilize multiple regression techniques in an effort to discover the relationships between various inputs to schools (e.g., teacher characteristics and peer group characteristics) and student outcomes (e.g., achievement test scores). The second methodology is used to study the educational impact of the relocation of students. Research of this type involves the use of longitudinal control group designs which serve to compare the outcomes of a group of students who were transferred from segregated to racially mixed schools with the outcomes of a group of students who remained in segregated schools. A feature which distinguishes between these two types of studies is that input-output research involves the consideration of the influences of numerous aspects of educational environments on student outcomes, while longitudinal control group research focuses on the effects of changes in school racial composition on student outcomes. In addition, the manner in which school racial composition is handled as an independent variable varies across the two methodologies. Input-output researchers compare the performance of groups of students who for any reason reside in schools of differing racial composition, while longitudinal control group researchers compare the performance of groups of students who reside in schools of differing racial composition as the result of official policy actions. The following two sections

discuss the inconsistent results as well as the major methodological weaknesses associated with both cross-sectional and longitudinal input-output studies as well as longitudinal control group research.

Cross-Sectional Input-Output Studies

The hypothesis most often examined with the input-output approach is that school resources and peer groups influence student outcomes over and above the effects exerted by individual backgrounds. Initially, cross-sectional data are gathered. Included in these data are a number of measures of school resources (such as staff characteristics and physical facilities) as well as a variety of measures relating to both the background and performance of individual children. These background and performance measures are then averaged within schools and used to describe some of the characteristics of the student body. Finally, pupil performance is regressed on measures of school resources and peer group characteristics, while employing some form of covariance analysis to statistically control for the backgrounds of individuals.

The most well-known research effort concerning the nature of school effects is the Office of Education Survey of Equality of Educational Opportunity (Coleman et. al., 1966). Coleman and his associates concluded that school resources exert little influence on student achievement that is independent of individual background characteristics and peer environment. Also, a significant relationship was found between the social context of the school and student performance, although this association was relatively slight in comparison to the effects of individual characteristics on student achievement. The original data were reanalyzed, and, for the most part, Coleman's basic findings were supported (Mosteller and Moynihan, 1972).

Although Coleman's analysis was performed on a large sample, his findings cannot be looked upon as conclusive. An overview of other investigations of school effects suggests that a number of school resources may have substantial impact on student achievement. Numerous studies have identified positive relationships between teachers' characteristics and academic outcomes, even after controlling for students' socio-economic status (Goodman, 1959; Thomas, 1962; Burkhead, Fox and Holland, 1967; Raymond, 1968; Katzman, 1968; Levin, 1970; Guthrie et. al., 1971). Within each of these studies, some combination of teachers' experience, teachers' education, and teachers' salary are shown to have positive effects on student achievement. Research which links instructional expenditures to student outcomes (Benson, 1965; Kiesling, 1967; Ribich, 1968) also supports the importance of school personnel, because the majority of instructional expenditures are allocated for staff salaries. In a somewhat related finding, Bidwell and Kasarda (1975) established associations between the organizational structure of school districts and pupil performance, while operationalizing organizational structure as ratios between the different levels of school personnel. Additional research suggests that student outcomes may be linked to school resources other than those associated with school personnel. Economists Cohn (1968) and Katzman (1968), for example, discovered economies of scale related to school size and school district size respectively.

In short, many cross-sectional input-output studies establish statistically significant relationships between school resources and student performance even after taking into account the influence of students' family backgrounds. However, Averch (1974) justifiably argues that the most salient feature of cross-sectional input-output studies

is the inconsistency of their results. In reviewing studies of the impact of characteristics of school environments on student outcomes, Averch provides clear evidence that the same school resources are not linked to academic performance across studies.

Disagreement also exists across cross-sectional input-output investigations concerning the impact of student body characteristics on pupil performance. On one hand, it is not difficult to locate researchers who concur with Coleman's conclusion regarding the influential nature of school social contexts. Michelson (1970) provides evidence that the academic ability level of a student's peer group is positively related to a student's own academic performance. Perl's (1973) research demonstrates that attending a school with a relatively high social class student body has a positive impact on pupil performance. In addition, McPartland (1969) and the U.S. Commission on Civil Rights (1967) both found that the performance level of black students in racially mixed classrooms was higher than the performance level of black students in segregated classrooms. However, evidence to the contrary also is prevalent. For example, Hauser (1970) and Smith (1972) argue that the influence of peer groups might be so small as to have no implications for educational planning.

There appear to be two plausible explanations for the lack of uniformity in the results of cross-sectional input-output investigations. One might argue that the evidence suggests that the set of independent variables included in these analyses simply are not important determinants of academic outcomes. However, it is also possible that the inability of this type of research to establish consistent correlates of student performance may be linked to the restrictive nature of their data and statistical models. The following paragraphs

contain a discussion of the methodological problems which pose the most severe threats to the validity of these studies:

1) A majority of the cross-sectional input-output studies utilize data which are aggregated (or averaged) at the school level. [1] The effect of this type of aggregation is that students who reside in the same school are assigned identical values on all measures relating to school environments. This involves the invalid assumption that all students within a particular school are exposed equally to each resource. Students in the same school are apt to have classmates with substantially different characteristics. Morever, school level aggregation creates a serious statistical problem. Because the independent variables must assume the same values for all students within each particular school, the school-to-school variation in the dependent variable represents the upper limit of the effects that may be attributed to the independent variables. Analyzing the Office of Education Survey of Equality of Educational Opportunity (EEO) data, Coleman and his associates and Smith (1972) computed the between school component of the total variance to be approximately 20%.

2) Bowles and Levin (1968) discuss the fact that measures of school resources covary with student backgrounds. Put more simply, children of high socio-economic status tend to reside in schools with higher levels of purchasable resources and more advantaged students. This collinearity creates problems when attempting to discover the magnitude

1. Although a majority of the cross-sectional input-output studies are based on data which are aggregated at the school level, several studies of this type (e.g. McPartland (1969) and U.S. Commission on Civil Rights (1967)) did utilize data aggregated at the classroom level. This classroom level aggregation was made possible by a question contained in the Office of Education Survey of Equality of Educational Opportunity, which asked students to estimate the racial composition of their classrooms.

of the effects of school environments on student outcomes because much of the variation in student outcomes is accounted for jointly by school-related and background variables. One method of handling this problem is to determine the independent effects of school environments while statistically controlling for individual backgrounds. However, this method tends to underestimate school effects because all of the variance accounted for jointly by school-related and background variables is attributed uniquely to the latter. An alternative is to attribute a portion of the variance in the dependent variable to the overlap between student backgrounds and school resources (Mood (1971) describes this method of partitioning variance). However, background factors again contaminate an estimation of the magnitude of school effects.

3. Another flaw in this genre of research concerns the tenuousness of deriving causal inferences from ex post facto analyses based on cross-sectional data. To begin, one can never be sure whether the presumed independent variable is actually affecting the ostensibly dependent variable, or vice versa. For example, a high correlation between level of teacher experience and student performance could be interpreted as evidence for the proposition that higher levels of teacher experience lead to higher levels of student outcomes. However, an equally plausible rival hypothesis can also be construed -- experienced teachers may be self-selecting into higher achieving classrooms.

Perhaps an even more serious challenge to cross-sectional research is that a valid determination of the potential impact of reorganizing educational environments cannot be made. Coleman's research provides a good illustration of this point. In EEO, Coleman discussed how minority students in racially mixed schools outperformed minority students in

segregated schools even after controlling for the effects of family backgrounds, which prompted the inference that black students would benefit from moves to racially mixed schools. This inference, however, far exceeds the limitations of the data because the EEO survey did not gather data on students that had actually changed schools.

Longitudinal Input-Output Studies

More recently, Hanushek (1971), Murnane (1975), Winkler (1977), and Summers and Wolfe (1977) have conducted longitudinal examinations of the input-output nexus in education. Representing major methodological improvements over cross-sectional analyses, each of these investigations explored the associations between gains in student performance and characteristics of school environments. In addition, all these studies, with the exception of Winkler's, were able to avoid the problems linked to school level aggregation by matching students to their particular teachers and classrooms.

In a longitudinal analysis of third grade academic achievement in a large California school system, Hanushek employed a statistical model which included a measure of each student's first grade achievement. This strategy enabled Hanushek to control for the effects of innate ability as well as past learning experiences, and consequently to estimate the incremental gains or "value-added" to students' performance by their second and third grade school environments.

Before computing equations, Hanushek stratified his sample into three groups on the basis of race and father's occupation -- Mexican-American, white manual, and white non-manual. For the Mexican-American sample, the results indicated that variations in school inputs had little or no impact on academic achievement. Possible explanations for this finding are that the sample size was inadequate and that the

absence of Mexican-American teachers in the school system may have resulted in an insurmountable language barrier. The findings with respect to white students' achievement, however, were much less dismal. For white pupils whose fathers' occupation was classified as manual, the verbal ability of both second and third grade teachers had a positive impact on achievement. In addition, the number of years since the second and third grade teachers' most recent educational experience as well as the amount of time spent on discipline by the third grade teacher adversely affected academic performance. By way of contrast, a somewhat different set of school inputs assumed importance for white children from non-manual occupation families. Although variables measuring the recency of teachers' last educational experience maintained their importance, teachers' level of experience with this particular socio-economic group preempted the variables concerning teachers' verbal ability and time spent on discipline as significant determinants of student performance. When making overall comparisons between the two groups of white students, school inputs were more important for the manual than the non-manual group. Finally, one more of Hanushek's findings merits note -- no support was found for hypotheses linking characteristics of students' peer group and pupil outcomes.

Utilizing a model similar to Hanushek's, Murnane's analysis of New Haven students' second and third grade achievement test scores also identified several school-related variables which had a positive impact on academic performance. After determining that significantly different amounts of learning occur across classrooms, Murnane identified teacher experience as the school input having the most substantial impact on achievement gains. Murnane's equations demonstrated that teacher effectiveness increases during the first two years of teaching and reaches

a peak somewhere between the third and fifth years of teaching. However, the findings reveal that there is no relationship between teacher experience and pupil outcomes for teachers who have spent more than five years in the classroom. Support for several other relationships also can be found in Murnane's study. First, male teachers seemed to work better with black students than female teachers with similar levels of experience. Second, black teachers with less than six years of experience were more successful than white teachers in teaching verbal skills to black children. Third, a high rate of student turnover had an adverse affect on pupils' reading performance, especially for relatively high achievers. Finally, as in Hanushek's study, Murnane found that the race and socio-economic status of students' peer groups were not consistently related to their academic performance.

Data from the Richmond Youth Project formed the basis for Winkler's longitudinal analysis of the factors affecting student achievement. As this data base differed from the ones used by Hanushek and Murnane, the structure of Winkler's analysis was necessarily dissimilar. On the positive side, Winkler was able to secure measures of school resources for an eight year period, which allowed him to study the impact of school environments on pupil outcomes over a longer period of time. However, as these measures of school resources were aggregated at the grade-level for three-year intervals, Winkler's analysis suffers from a lack of pupil-specific data.

Methodological issues aside, Winkler's results support the conclusion that the characteristics of school environments to which children are exposed during their entire elementary school careers do affect their

achievement levels in the sixth and eighth grades even after taking into account first grade test scores. To begin, the teacher element emerged as significant in a number of Winkler's equations. Teachers graduating from more prestigious colleges seemed to improve black achievement as well as the achievement of lower socio-economic status whites. In addition, Winkler's findings with respect to the importance of students' peer groups differed significantly from the two previously discussed longitudinal investigations -- black students seemed to suffer when a disproportionate amount of their classmates were from lower social class families. Interestingly, Winkler also found that sharp increases in the proportion of white students which accompanied pupils' moves from elementary to junior high school had a deleterious effect on black achievement. Taken together, these two findings suggest that desegregation may be beneficial for minority students only if it occurs during the early grades.

Another approach to the examination of the school-related correlates of achievement growth was adopted by Summers and Wolfe in their analysis of Philadelphia public elementary school students. The dependent variable used in this study was the change in students' composite achievement score between the third and sixth grades. This variable was regressed on measures of each individual student's family background, sixth grade teacher characteristics, sixth grade classmate characteristics, sixth grade school characteristics, as well as a number of school level variables averaged over the three year period. Perhaps the most problematic feature of this approach is the tendency to overestimate the importance of student's sixth grade environment while obscuring the impact of fourth and fifth grade environments.

After controlling for the effects of family background variables and IQ, several aspects of school environments emerged as important determinants of achievement growth. Teachers graduating from high quality colleges were more effective instructors of low income children than teachers with degrees from less prestigious institutions. The interaction of teachers' experience and students' achievement level also was found to be important -- teachers with high levels of experience were beneficial for high achieving students, yet had a deleterious impact on the performance of relatively low achieving pupils. In addition, school and class sizes assumed importance. Low achievers were adversely affected by large class sizes, while small schools helped all students, especially blacks. Finally, Summer's and Wolfe's findings corroborate the work of Winkler which suggests that classroom social context exerts an impact on low achieving pupils. Although high achievers were not affected by the average achievement level of their classmates, low achievers placed with relatively high achieving peers did perform significantly better than low achieving students in classrooms where the average level of achievement was depressed.

In summary, differences clearly exist across longitudinal investigations of school effects with respect to which characteristics of educational environments under the control of high level school policymakers have an impact on academic performance. However, the question concerning whether significantly different amounts of learning occur as a result of exposure to different levels of school characteristics of this nature appears to have been strongly answered in the affirmative. Morever, strong evidence exists for the proposition that educational environments are most important for the black and the poor.

Finally, the major problem with previous longitudinal input-output studies is that they provide educational policymakers with little useful information. This situation results from the failure of these studies, excepting the small piece of Winkler's work that focused on the effects of changes in the racial composition of students' peer group which accompanied their move from elementary to junior high school, to analyze the influence of environmental changes on achievement gains. Hence, reliable conclusions cannot be drawn relating to the potential returns which would accrue to desegregating schools or modifying patterns of resource allocation.

Longitudinal Control Group Studies

Another strand of research aimed at informing educational equity policy is termed longitudinal control group research. Researchers using this method examine the changes in academic performance as a function of changes in racial composition which accompany student relocation to new schools. These investigations each contain a quasi-experimental comparison between a cohort of black students who transferred from segregated to racially mixed schools and a control group which remained in segregated schools. Studies of this nature are much narrower in scope than input-output analyses because they focus almost exclusively on testing the hypothesis that changes in school racial composition affect student outcomes. What is sacrificed in scope, however, is potentially gained in the increased ability to make sound predictions of the academic effects which would result from various desegregation strategies. Unfortunately, much confusion surrounds the findings of longitudinal control group analyses -- confusion for which methodological problems again appear to be primarily responsible.

An overview of several longitudinal control group studies (Armor, 1972; Evans, 1973; Frary and Goolsby, 1970; Hsia, 1971; Laird and Weeks, 1966; Mahan, 1968; Mayer et. al., 1974; Morrison and Stivers, 1971; Zdep, 1971) as well as the four most comprehensive reviews of the literature (Bradley and Bradley, 1977; Crain and Mahard, 1977; St. John, 1975; Weinberg, 1977) quickly exhibit the wide range of opinion concerning the impact of school desegregation on student performance. Utilizing Bradley and Bradley's and St. John's criteria for evaluating this type of investigation, the following section discusses the major methodological weaknesses which may account for a substantial portion of the variability in the results of these studies.

To begin, two important assumptions must be met in order to ensure a valid comparison between a group of students who transferred from segregated to desegregated schools and a control group which remained in segregated schools. First, the possibility of uncontrolled differences between the two groups of students cannot exist. Second, the segregated and desegregated schools contained in each study must be equivalent, with the exception of racial composition. Only under these circumstances can rival hypotheses be discarded, and the differences between the two groups be attributed solely to changes in racial composition.

Mahan's (1968) study of the academic impact of a bussing program in Hartford, Connecticut (Project Concern) provides a good opportunity to examine the ways in which longitudinal control group studies fail to satisfy the criteria outlined in the preceding paragraph. First, Mahan's investigation lacked a comparison between equivalent groups, one which attended segregated schools and the other which attended

racially mixed schools. As the group of bussed students were volunteers while the control students were not, any differences in the achievement gains of the two groups cannot be linked to changes in school social composition with any degree of confidence. Second, the bussed students were assigned to racially mixed suburban schools while the control group remained in predominantly black inner city schools. Because the sending and receiving schools differed both in racial composition and level of school resources, it is impossible to evaluate the unique impact of either.

Armor's study of Boston's METCO desegregation program also furnishes several examples of the sources of invalidity which characterize longitudinal control group investigations. Initially, the equivalence of Armor's experimental and control groups must be questioned. In an effort to control for the socio-economic status of the two groups, Armor built a control group composed of the siblings of the bussed children. As the large number of applications to the bussing program necessitated the policy that only one child per family could be accepted to the program, parents were forced to choose which of their children would participate in the program. Thus the possibility exists that the control group differed significantly from the group of bussed students because parents may have had a systematic tendency to send their children who learned more slowly (or more quickly) to desegregated schools. Second, Armor's study is subject to the familiar criticism that the inner-city schools attended by the control group were quite unlike the bussed students' suburban schools. Third, Armor's analysis suffers from what Campbell and Stanley (1963) term experimental mortality -- "differential loss of respondents from the comparison groups

(p.5)"; only about one half of the bussed students and one quarter of the control students were present for both the pre-test and the post-test. Finally, Pettigrew et. al. (1972) point out the astounding fact that many of the students in Armor's control group actually attended desegregated schools. In light of these methodological flaws, it is difficult to interpret Armor's finding of no significant difference between his experimental and control groups.

In general, Mahan's and Armor's studies exemplify the major methodological problems which raise questions concerning the reliability of the results of longitudinal control group research. Passing quickly through the most severe shortcomings of several other studies of this nature, the research conducted by Evans, Frary and Goolsby, Hsia, Laird and Weeks, Mayer et. al., and Morrison and Stivers in some way failed to meet the criterion of equivalence between the experimental and control groups. By way of contrast, both Rock's and Zdep's investigations violated the criterion of equivalence between the sending and receiving schools. Thus, even though all of the studies mentioned above except Hsia's demonstrated some beneficial effect associated with attending racially mixed schools as opposed to segregated schools, methodological limitations make it difficult to draw sound conclusions from these studies,

Perhaps the best attempt to integrate the findings produced by this area of research is the recent survey of the literature conducted by Crain and Mahard (1977) of the Rand Corporation. The general conclusion of this review was that school desegregation plans could exert a positive impact on black student performance, especially if the desegregation plans were mandatory and if the participating students

were in the early primary grades. Of the thirty-nine investigations that Crain and Mahard identified as studying the impact of mandatory desegregation plans, those reporting positive effects outnumbered those showing negative effects by four to one. In addition, a similar ratio of positive to negative findings emerged when examining the effects of desegregation programs begun before the third grade. But even though Crain and Mahard's work is cause for some optimism, inadequate research designs still leave questions concerning optimal desegregation strategies basically unanswered.

Conclusion

A comprehensive examination of the previously conducted input-output and longitudinal control group research indicates that confirming as well as disconfirming evidence can be found for almost any conceivable hypothesis linking a purchasable school resource or an aspect of school social context to student performance.[2] As a result, a compelling case for pursuing any particular course of educational reform aimed at improving minority achievement has not emerged from school effects research.

Given the preponderance of school effects research and the lack of substantive information provided to educational policymakers, it might be argued that additional studies of this nature would yield insignificant returns. However, consideration of the developmental progress which has occurred in this genre of research suggests a different conclusion. As school effects research evolves and the shift toward conducting more

2. Recent publications by Bridge, Judd, and Moock (1979) and Bradley and Bradley (1977) provide comprehensive tables which array the results of much of the recent input-output and longitudinal control group research.

methodologically sound longitudinal studies continues, design problems are slowly being overcome. To be sure, investigations of school effects can never be void of methodological flaws because studies of this nature cannot possibly be structured as perfectly controlled experiments. But as evidence derived from more sufficient research designs begins to accumulate, an important knowledge base appears to be developing.

Chapter 3

DESCRIPTION OF THE DATA AND THE METHODOLOGY

This study uses a variant of the input-output approach to examine the nature of school effects, which is cause to be wary of the particular methodological limitations associated with this type of investigation. However, the data which form the basis of this research permit the construction of a research design that minimizes these methodological weaknesses. The purpose of this third chapter is to describe the data and the sample utilized in this research as well as to present the basic research design.

The Data and the Sample

The St. Louis Public Schools' Division of Evaluation made available numerous data files for use in this study. To begin, access was granted to the Elementary School Accounting System files for the 1976-77 and 1977-78 school years. These files each contain information on every student residing in the St. Louis Public Elementary Schools, including demographic information, school and classroom location, and date of enrollment. Merging these two years of data by student identification number resulted in the formation of a data set containing a longitudinal record for each student. This new data set was then combined with the Iowa Test of Basic Skills (ITBS) data file, which included each student's spring achievement test scores for the years 1976 to 1978. Finally, a collection of data consisting of school level information for the 1976-77 and 1977-78 school years was added to form the completed data set. This school level information was gathered from Elementary School Profiles, which are published annually by the Division of Evaluation. A discussion of the particular variables contained in the completed data set will be outlined later in this chapter.

The sample utilized in this study includes two groups of black students, both of which contain students who were transferred from one school to another as the result of administrative decisions. The first group is composed of students who were labelled: "transported for overcrowding at the home school." The second group consists of students who changed schools as the result of permissive transfers, which are transfers requested by parents and granted by the St. Louis Board of Education only if they result in the reduction of racial isolation at both the sending and receiving schools.

The process of selecting a sample began with the identification of 3,198 students who were classified as either "overcrowding transfers" or "permissive transfers". The number of children eligible to be included in the final sample was then reduced to 2,775 by eliminating 423 pupils who did not reside in the St. Louis Public Elementary Schools during the 1976-77 school years. These 423 students had to be dropped because only one year of data was available for each of them. The next step was to exclude 1,052 pupils who did not actually change schools between the 1976-77 and 1977-78 school years. For this group of students, a 1977-78 transfer code represented a continuation of a previously established transfer plan. Subsequently, the number of students eligible for the final sample was reduced from 1,723 to 1,225 by excluding 498 children who did not spend a full school year in both the sending and receiving school. These students were dropped because valid measures of their school environments could not be constructed. The pool of candidates then decreased to 736 with the exclusion of 489 students whose longitudinal achievement record did not contain the three years of data necessary to construct a measure of their change in the rate of achievement growth.

In addition, 19 more students were eliminated because either keypunch or coding errors appeared in their achievement test data. Next, the sample diminished to 675 as all students who either skipped or were held back a grade (or had a keypunch error associated with their grade) were purged. The final phase of sample selection entailed eliminating 14 remaining white students as well as excluding all students whose records contained a missing value for any of the variables included in the forthcoming statistical analysis.

Concern about the representativeness of the final sample, which contains 624 black students, can be alleviated by comparing the average achievement level of the sample with the achievement level of the average black student in the St. Louis Public Elementary Schools. As the following table indicates, the achievement level of the sample used in this study closely approximates the average achievement level of elementary students residing in the predominantly black sub-districts of the St. Louis Public Schools as reported in ITBS Trends (St. Louis Public Schools).

Insert Table I

The final sample is composed of 602 pupils classified as overcrowding transfer students and 22 children classified as permissive transfer students. These 624 pupils emanated from a total of 71 sending schools and were received by a total of 36 schools. The moves of the 602 students who were coded "transported for overcrowding at the home school", involved a total of 67 sending schools and 33 receiving schools.

As 67 elementary schools in St. Louis are not overcrowded, an investigation was undertaken to determine why the number of sending schools

Table I

Comparison of the Initial Achievement
Level of the Sample with Sub-District and Citywide
Composite Achievement Levels

	Sample N	Sample	Predominantly Black Sub-District #1 Average	Predominantly Black Sub-District #2 Average	Predominantly Black Sub-District #3 Average	Citywide Average
Grade 2	21	2.88	not reported	not reported	not reported	not reported
Grade 3	54	3.60	3.08	3.45	3.26	3.40
Grade 4	174	4.14	4.06	4.26	4.05	4.27
Grade 5	156	5.04	4.81	5.09	4.98	5.17
Grade 6	164	5.98	5.73	6.22	5.83	6.15
Grade 7	55	6.98	6.52	6.91	6.72	7.01

was so large. To begin, the ten sending schools from which the largest number of moves originated were identified. These ten schools represented the sending schools for 446 of the 602 students. An examination of these ten schools revealed that seven were actually overcrowded and the other three were either closed or converted to magnet schools the following year.[1] Hence, it appears that a number of students whose transfers were associated with school closings and conversions are included in the group of students labelled "transported for overcrowding". However, many of the other 57 schools were neither overcrowded nor closed or converted, but still served as sending schools for a small number of students who were supposedly transported for reasons of overcrowding. School officials explained this situation by suggesting that students are transported as the result of a condition at their home school, and it is possible that some students might have already been attending sending schools away from their home attendance areas. Finally, it is improbable that the "transported for overcrowding" code encompasses disciplinary transfers and transfers for special educational reasons, because other codes are available to represent these types of moves. Because elementary schools in St. Louis that are closed or converted also tend to be underutilized (see Colton and Frelich (1979)), many students included in this sample were actually transported from underutilized school buildings.

Statistical Model and Analytic Methods

The statistical model presented in this section is designed to reduce

1. The sample for this study includes one student who was transferred from a magnet sending school into regular school. No other moves involved a magnet school as either a sending or receiving school.

the threats to the validity of this study posed by the previously mentioned methodological problems which have flawed earlier input-output analyses of educational effects -- inappropriate levels of data aggregation, covariation among measures of individual backgrounds and school environments, and the failure to directly analyze the effects of changes in school environments.

To begin, school level aggregation of peer characteristics can be avoided, because the data allow for the matching of students to specific classrooms. Second, the collinearity problem can be managed through the construction of a unique dependent variable, which is termed change in the rate of academic growth. This variable will be computed as the difference between a student's two academic gains during two consecutive years, one at the sending school and one at the receiving school. As a student's individual background can be assumed to be influential in each of the two years, it follows that there should be little correlation between individual backgrounds and students' change in the rate of academic growth. Concomitantly, statistically controlling for the effects of background characteristics should not contaminate an estimation of school effects. Empirical verification of this assumption can be found in an analysis conducted by Anderson, Haller, and Smorodin (1976), which utilized a sample of students who transferred between high schools. In this study, changes in educational aspirations were regressed on changes in school social context and measures of individual backgrounds, and no significant associations were found between the individual background variables and students' changes in educational aspirations. Third, the design utilized in this study actually examines the effects of changing school environments, as the independent variables are constructed

as indices of changes between each student's two educational environments which occurred as the result of their relocation to a new school. Accordingly, this research will yield reliable information concerning the potential academic benefits which would accrue to future manipulations of educational settings. In addition, it should be noted that this methodological advance incorporates the strength of the longitudinal control group design, which is the ability to make reliable predictions concerning the efficacy of particular policy actions, into the input-output approach.

In mathematical form, the statistical model which provides formal tests of the relationships between the input variables and a student's change in the rate of academic growth is as follows:

$$(AG_{it} - AG_{i(t-1)}) = b_0 + b_1(SRV_{it} - SRV_{i(t-1)}) + b_2(CCV_{it} - CCV_{i(t-1)}) + b_3(SCV_{it} - SCV_{i(t-1)}) + b_4(IBV_i) + e_i$$

where:

AG_{it} = gain in achievement for individual i during year t.

$AG_{i(t-1)}$ = gain in achievement for individual i during the previous year.

SRV_{it} = school resource inputs for individual i during year t.

$SRV_{i(t-1)}$ = school resource inputs for individual i during the previous year.

CCV_{it} = classroom social context inputs for individual i during year t.

$CCV_{i(t-1)}$ = classroom social context inputs for individual i during the previous year.

SCV_{it} = school social context inputs for individual i during year t.

$SCV_{i(t-1)}$ = school social context inputs for individual i during the previous year.

IBV_i = individual background characteristics for individual i, and where

b_1, b_2, b_3, and b_4 are weights assigned to the various influences and b_0 is a constant. These weights are computed in a manner which minimizes the squared deviations of the predicted value of (AG_{it} - $AG_{i(t-1)}$) from its observed value. This is equivalent to minimizing the sum of squares of e_i.

The research design delineated above serves to test the strength of the associations between specific changes in characteristics of school environments and students' change in the rate of academic growth. Put more simply, this design can show whether certain types of changes in school environments account for the variations in students' achievement growth patterns.

The Variables

Change in the Rate of Academic Growth. The dependent variable, change in the rate of academic growth, involves the use of three consecutive spring achievement test scores for each student included in the sample. For each of the three years, a pupil's composite score on the Iowa Test of Basic Skills (ITBS) expressed in grade equivalents is used to represent achievement. The following four tests, with their component subtests parenthetically noted when present, will enter into the calculation of this composite score -- Vocabulary, Reading Comprehension, Language Skills (Spelling, Capitalization, Punctuation, Usage), and Mathematical Skills (Mathematics Concepts, Problem Solving).

Initially, a measure of each pupil's rate of academic growth in the sending school was calculated as the difference between the student's spring test score at the sending school and his/her test score the previous spring. Next, the student's rate of academic growth in the receiving school was obtained by subtracting his/her spring test score

at the sending school from the spring test score at the receiving school. Finally, the difference between these two rates of academic growth was computed and used to measure a student's change in the rate of academic growth.

It often has been noted that creating change scores by simply subtracting one test score from another might create several problems (Lord, 1956; McNemar, 1958; O'Connor, 1972). One such problem is that changes at different points on a scale may not be comparable. For example, a four minute miler who cuts ten seconds from his time has surely accomplished more than an eight minute miler who performed a similar feat. In this study, the problem discussed above is handled by the use of grade-equivalent scores, which are described in the following manner in the Iowa Tests of Basic Skills Manual for Administrators, Supervisors, and Counselors (Hieronymus and Lindquist, 1974):

> The grade-equivalent score scale is a "developmental" scale. It may be thought of as an "anchor" or a "universal" score scale that represents the entire range of skills development in the elementary school and is used to relate raw scores from the various levels to each other. (p.21)

Another potential problem arises from the fact that all test scores are partially composed of random measurement error. Consequently, the estimates of students' change in the rate of academic growth used in this study necessarily contain some degree of random error, which serves to reduce the correlation coefficients between the independent variables and the dependent variable. However, the magnitude of this second problem is somewhat reduced by the use of composite scores, for which the error of measurement is extremely small. This claim is substantiated by the reliability coefficients for the composite score reported in the ITBS Manual, which range between .97 and .98 for split-

halves reliability and .96 and .97 for equivalent forms reliability (depending upon the grade level of the pupil to which the test is administered).

School Resource Variables. The particular indices which are included as measures of school resources were determined by an analysis of empirical studies, theoretical speculation, the availability of data, and most importantly, by discussions with school officials. At the outset, it was hoped that school level aggregation of teacher characteristics could be avoided by matching an individual classroom teacher to each child. However, communications with school officials indicated that this would not adequately represent the educational process. For most seventh and eighth graders, who constitute 35% of the sample, instruction is departmentalized -- each classroom of students is taught different subjects by different teachers. In light of this departmentalization, this study utilizes teacher data aggregated at the school level.

Initially, school level inputs were obtained for each student's sending and receiving school environments. Then the differences between the student's two environments on each of the measures were computed to represent changes in school resources. A list of the individual variables which compose the total cluster of school resource variables follows:

Changes in:

1) School Size
2) Pupil/Classroom Ratio
3) Teachers' Level of Educational Training
4) Teachers' Level of Experience

5) Teachers' Rate of Attendance

6) Percent Teachers Non-White

7) Availability of Title I Programs.

Classroom and School Social Context Variables. Although departmentalized instruction necessitated the aggregation of resource variables at the school level, it was possible to create measures of students' social contexts that are more pupil-specific. Discussions with school officials indicated that classroom groups remain relatively intact throughout the school day despite departmentalized instruction, which suggests that it is valid to aggregate data at the classroom level to represent the characteristics of each student's peer group. Three indices are used to represent the extent to which each student's classroom context changes:[2]

Changes in:

1) Classmates' Mean Composite Achievement

2) Percent Classmates Non-White

3) Percent Classmates Eligible for Free Lunch. [3]

In addition, six indices of school-level changes in each student's social context are included in the statistical model as independent variables:

Changes in:

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2. These indices were coded as missing values for all students with less than 10 identifiable classmates. This caused these students to be dropped from the sample. For students included in the sample, identifiable class sizes normally ranged from 18 to 33.

3. Depending upon their socio-economic status, students in the St. Louis Public Elementary Schools each fall into one of three categories with respect to receiving a lunch subsidy -- eligible for free lunch, eligible for lunch at a reduced price, or ineligible for a lunch subsidy.

1) Students' Attendance Rate

2) Students' Mean IQ

3) Percent Students Non-White.

Individual Background Variables. Five measures of each student's individual characteristics also will be included as independent variables:

1) Grade Level (at the Sending School)

2) Sex

3) Type of Transfer (Permissive or Mandatory)

4) Level of Lunch Subsidy

5) Initial Achievement Level (Spring 1976).

As many of the general variables outlined in this chapter assume different forms in the forthcoming statistical analyses, a more detailed description of the values associated with the specific forms of the variables will be provided in the following chapter.

Chapter 4

PRESENTATION OF THE EMPIRICAL ANALYSES

Chapter Four contains a presentation of empirical findings. The first part of the chapter reports the results of the regression analysis outlined in Chapter Three. From this more general analysis, certain changes in school characteristics emerge as important determinants of black students' academic performance. Subsequently, other statistical approaches are applied to the data in an effort to better estimate the magnitude of the impact that certain school characteristics have on the performance of black pupils.

Initial Regression Analyses

Figure 1 provides abbreviated names and definitions for all of the independent variables included in the initial set of regression equations. In this figure, the variables are grouped by their membership in particular clusters, or levels of analysis.

Insert Figure 1

The mean and standard deviation for each of the independent variables is displayed in Table II. In addition, Table II contains similar statistics for the dependent variable, change in the rate of academic growth (CRAG).

Insert Table II

Many of the means reported in Table II merit special attention. To begin, the mean change in the rate of academic growth (CRAG) is -.41, which indicates that the average student's achievement growth rate was approximately four-tenths of a month per year slower in the receiving school than in the sending school. Table II also shows that the mean

Figure 1

Descriptions of the Variables

Individual Background Variables (IBV)*

1) PERTRAN (1 = permissive transfer, 0 = overcrowding transfer)

2) SEX (1 = male, 0 = female)

3) GRADE 2 (1 = second grader in sending school, 0 = otherwise)

4) GRADE 3 (1 = third grader in sending school, 0 = otherwise)

5) GRADE 4 (1 = fourth grader in sending school, 0 = otherwise)

6) GRADE 5 (1 = fifth grader in sending school, 0 = otherwise)

7) GRADE 6 (1 = sixth grader in sending school, 0 = otherwise)

8) LSUBPAY (1 = student pays for lunch, 0 = otherwise)

9) LSUBFREE (1 = student provided with free lunch, 0 = otherwise)

10) INITCOMP (student's composite achievement score in the spring prior to attendance at the sending school)

The variables GRADE 7 (1 = seventh grader in sending school, 0 = otherwise) and LSUBPART (1 = student eligible for lunch at reduced price, 0 = otherwise) were necessarily eliminated from the regression equations to avoid an overspecified model.

* expressed in months above or below grade level

School Social Context Variables (SSCV)

1) CHSTATT (change in schoolmates' attendance rate)

2) CHPSNW (change in % schoolmates non-white)

3) CHSMIQ (change in schoolmates' mean IQ)

Classroom Social Context Variables (CSCV)

1) CHLSUB (change in % classmates receiving a free lunch)

2) CHCOMPM (change in classmates' mean composite achievement score)

3) CHRACE (change in % classmates non-white)

Figure 1 (cont.)

School Resource Variables (SRV)*

1) CHENROLL (change in student enrollment)

2) CHTED (change in % teachers with no graduate degrees)

3) CHTEXP (change in % teachers with less than 4 years of experience)

4) CHTATT (change in teachers' attendance rate)

5) CHPTNW (change in % teachers non-white)

6) CHPCR (change in pupil/classroom ratio)

7) TITLE1D0 (1 = no Title I services in either the sending or receiving school, 0 = otherwise)

8) TITLE1D1 (1 = no Title I services in the sending school and Title I services in the receiving school, 0 = otherwise)

9) TITLE1D2 (1 = Title I services in the sending school and no Title I services in the receiving school, 0 = otherwise)

*The variable TITLE1D3 (1 = Title I services in both the sending and receiving school, 0 = otherwise) was necessarily eliminated from the regression equations to avoid an overspecified model.

Table II

Descriptive Statistics

Variable	N	Mean	Standard Deviation
CRAG	624	-0.41506410	10.38701331
PERTRAN	624	0.03525641	0.18457517
SEX	624	0.46314103	0.49903960
GRADE 2	624	0.03365385	0.18048121
GRADE 3	624	0.08653846	0.28138309
GRADE 4	624	0.27884615	0.44879144
GRADE 5	624	0.25000000	0.43336008
GRADE 6	624	0.26282051	0.44051888
LSUBPAY	624	0.11378205	0.31780112
LSUBFREE	624	0.84134615	0.36564609
INITCOMP	624	1.26282051	8.82638841
CHSTATT	624	-1.69057692	2.73348530
CHPSNW	624	-22.15879808	31.71236840
CHSMIQ	624	2.75461538	4.01082034
CHLSUB	624	-27.28275230	27.95908649
CHCOMPM	624	10.20443886	7.62622289
CHRACE	624	-17.93817784	25.07302501
CHENROLL	624	-110.61217949	237.30071862
CHTED	624	-5.14786859	13.83023055
CHTEXP	624	16.01900641	10.07906148
CHTATT	624	0.25463141	2.93452141
CHPTNW	624	-7.63161859	19.95016312
CHPCR	624	1.13833333	4.21559367
TITLE1D0	624	0.09775641	0.29722326
TITLE1D1	624	0.00480769	0.06922614
TITLE1D2	624	0.31891026	0.46642808

of INITCOMP is 1.26. This mean indicates that the average student's initial spring composite achievement score was roughly one month higher than the grade level in which he or she was enrolled. As spring achievement tests occur at the end of the school year, student's test scores would have to be 10 months (or one year) above their grade level in order to be at the national norm. The mean of CHCOMPM reveals that receiving classroom environments on average had an achievement level about 10 months higher than that of sending classrooms. In this case, general expectations are confirmed, because receiving classrooms were always one grade level higher than sending classrooms. Table II also shows that receiving school environments tended to have a lower percentage of black students than sending school environments as indicated by the negative means of CHPSNW and CHRACE. Given these means, it is not surprising that receiving schools also tended to have a lower percentage of very poor students -- the average receiving school had 27% fewer students receiving a free lunch (CHLSUB).

Also important to mention with respect to Table II is that the reported standard deviations are generally quite large. The high degree of variation which exists among the values of the individual variables is very advantageous because without variation it is impossible to determine relationships between variables.

A comprehensive correlation matrix is reported in Table III. Attention should be focused on the first column of the matrix, because this column contains the zero-order correlation coefficients which measure the strength of the associations between all twenty-five of the independent variables and the criterion variable. Of these twenty-five correlation coefficients, only four are statistically significant ($p \leq .05$).

Among these four relationships, initial composite achievement (INITCOMP), changes in teachers' rate of attendance (CHTATT), and changes in classmates' mean achievement level (CHCOMPM) are positively related to changes in the rate of academic growth. By way of contrast, enrollment in the sixth grade (GRADE 6) is inversely related to the dependent variable. Far and above the largest correlation contained in column 1 is that which associates changes in classmates' mean achievement level with the criterion.

Various correlations among independent variables are also important. First, a tendency exists for students in lower grades to have higher initial achievement scores relative to their grade levels than students residing in the upper grades. This tendency is shown by the dummy variables representing membership in grades two, three, and four being positively correlated with INITCOMP, while the dummy variables indicating enrollment in grades five and six are negatively correlated with INITCOMP. In simple terms, the longer students are in school, the further they fall behind.

A second set of correlations that deserve consideration are those which associate the set of classroom social context variables (CHLSUB, CHCOMPM, and CHRACE) to the set of school social context variables (CHSTATT, CHPSNW, CHSMIQ). As would be anticipated, the degree of collinearity is quite large. More will be made of this covariation in the discussion of the regression analysis.

Insert Table III

Tables IV, V, VI, and VII display the results of the regression analyses. Contained in each of these four tables are the findings of

Table III

Correlation Coefficients

	CRAG	PERTRAN	SEX	GRADE 2	GRADE 3	GRADE 4	GRADE 5	GRADE 6	LSUBPAY	LSUBFREE	INITCOMP	CHSTATT	CHPSNW	CHSMIQ	CHLSUB	CHCOMPM	CHRACE	CHENROLL	CHTED	CHTEXP	CHTATT	CHPTNW	CHPCR	TITLE1D0	TITLE1D1	TITLE1D2
CRAG	1.0																									
PERTRAN	-02	1.0																								
SEX	.03	-06	1.0																							
GRADE 2	-01	-04	.02	1.0																						
GRADE 3	.02	.06	.01	-06	1.0																					
GRADE 4	-01	-08	.04	-12	-19	1.0																				
GRADE 5	.08	-01	-03	-11	-18	-36	1.0																			
GRADE 6	-12	-02	-01	-11	-18	-37	-34	1.0																		
LSUBPAY	.03	.10	.01	.10	-07	-09	.05	.00	1.0																	
LSUBFREE	-02	-08	-05	-06	.07	-09	-04	-05	-83	1.0																
INITCOMP	.13	.07	-13	.16	.17	.01	-05	-10	-09	-03	1.0															
CHSTATT	-04	.00	.05	.05	.07	-09	.07	-31	.07	-10	-09	1.0														
CHPSNW	-01	-23	.06	-08	.00	-27	-11	-13	-16	-19	.06	-11	1.0													
CHSMIQ	.00	.11	-05	.10	.07	-20	-14	-07	.06	-10	-06	-43	-67	1.0												
CHLSUB	.03	-24	.02	-14	-05	-17	.00	.07	-25	-29	-02	-43	-56	-60	1.0											
CHCOMPM	-25	-13	-08	.02	.02	-06	-10	-12	.07	-10	.04	-19	-33	-46	-44	1.0										
CHRACE	.05	-31	.04	-10	-08	-22	.01	-07	-17	-19	.04	-22	-87	-66	-74	-39	1.0									
CHENROLL	.02	-01	.04	-08	-08	-08	-18	-11	.01	.01	-04	-32	-04	-31	-13	-08	-05	1.0								
CHTED	-07	-02	-10	-08	-17	-21	-12	-25	-04	-09	.00	-38	-28	.03	.05	-10	-19	-32	1.0							
CHTEXP	-07	-02	-04	.02	-03	-33	-06	-43	-08	.05	-01	-17	-30	-33	-08	.07	-22	.04	-12	1.0						
CHTATT	-09	-02	.00	-04	-12	-14	-02	-14	-10	-12	.02	.04	.03	-03	-05	.06	.00	-22	-13	-25	1.0					
CHPTNW	-03	-20	.06	-05	-06	-35	-12	-20	-11	-13	.00	.02	-78	-55	-44	-25	-67	-28	-21	-28	-09	1.0				
CHPCR	.01	.07	-05	-15	.07	-08	-06	.01	.01	.00	-11	-06	-21	-37	-35	-19	-27	-39	.03	-21	.02	-42	1.0			
TITLE1D0	.01	-03	-01	-06	-08	-09	.00	.07	-10	-18	-08	-15	-09	.06	-32	-19	-24	-16	-29	-07	-28	-17	-18	1.0		
TITLE1D1	.04	-01	.03	-01	-02	.01	-04	.01	-12	-10	.05	-02	-17	-14	.07	-03	-22	.03	.04	-09	.02	-14	-02	-02	1.0	
TITLE1D2	-02	-17	-04	-16	-11	-21	.03	.03	-09	-12	.03	-26	-75	-72	-66	-30	-71	-21	-02	-34	-19	-71	-52	-23	-05	1.0

___ statistically significant at the .05 level
___ statistically significant at the .01 level

three regression equations. The first column of each table specifies a regression equation in which one cluster of independent variables is used to predict the value of the dependent variable. In the second column of each table, a regression model is described which includes all of the independent variable clusters except for the cluster considered in the first column. Finally, the third column of each table specifies the full regression model in which the dependent variable is regressed upon all four independent variable clusters.

Insert Tables IV - VII

Consideration of the squared multiple correlations (R^2) contained in each table provides information concerning the proportions of variance in the change in the rate of academic growth that may be attributed to each cluster of independent variables. In addition, the proportions of variance in the dependent measure that are accounted for jointly by various combinations of independent variable clusters can be determined.

Models 3.2 and 3.3 can be used to obtain an estimate of the independent effect of the individual background variables (IBV) on the dependent measure. The full regression (Model 3.3) accounts for 15.9% of the variance in the dependent variable, as indicated by a squared multiple correlation of .159. Model 3.2 shows that school social context variables (SSCV), classroom social context variables (CSCV), and school resource variables (SRV) together account for 12.3% of the variance in the dependent variable. The independent effect of the individual background variable cluster can be ascertained by taking the difference between the squared multiple correlations of Models 3.2 and 3.3. This difference equals .036, which means that 3.6% of variance in the depen-

Table IV

Regression Equations for Estimating the Impact of Individual Background Variables on Changes in Students' Academic Growth Rates

	Model 3.1	Model 3.2	Model 3.3
	Coefficient	Coefficient	Coefficient
Intercept	2.1146	-2.7253*	.1816
PERTRAN	-2.3841		-1.1931
SEX	.9506		1.4791
GRADE 2	-4.8637		-4.8093
GRADE 3	-3.0105		-3.5361
GRADE 4	-3.0823		-4.6767**
GRADE 5	-1.3457		-4.2206*
GRADE 6	-4.7704*		-5.7261**
LSUBPAY	.1000		1.0556
LSUBFREE	-.2873		.5966
INITCOMP	.1729**		.1496**
CHSTATT		-.2291	-.2769
CHPSNW		-.0873*	-.0954*
CHSMIQ		-.1983	-.2119
CHLSUB		.0233	.0439
CHCOMPM		.4630**	.4528**
CHRACE		.1500**	.1519**
CHENROLL		.0016	.0029
CHTED		-.0010	-.0223
CHTEXP		-.0998*	-.0784
CHTATT		.1976	.1825
CHPTNW		.0010	.0082
CHPCR		-.0143	-.0755
TITLE1D0		1.3506	2.0403
TITLE1D1		-.8650	-3.105
TITLE1D2		2.4373	3.0292
R^2	.043	.123	.159
F-Ratio	2.75**	5.66**	4.53**

* statistically significant at the .05 level
** statistically significant at the .01 level

Table V

Regression Equations for Estimating the Impact of Classroom Social Context Variables on Changes in Students' Academic Growth Rates

	Model 4.1	Model 4.2	Model 4.3
	Coefficient	Coefficient	Coefficient
Intercept	-3.2782**	2.9485	.1816
PERTRAN		-3.2236	-1.1931
SEX		1.0971	1.4791
GRADE 2		-5.0922	-4.8093
GRADE 3		-3.5675	-3.5361
GRADE 4		-3.6728*	-4.6767**
GRADE 5		-2.7592	-4.2206*
GRADE 6		-5.8340**	-5.7261**
LSUBPAY		-.4332	1.0556
LSUBFREE		-.3178	.5966
INITCOMP		.1721**	.1496**
CHSTATT		-.3719	-.2769
CHPSNW		-.0203	-.0954*
CHSMIQ		.1682	-.2119
CHLSUB	.0346		.0439
CHCOMPM	.4545**		.4528**
CHRACE	.0463		.1519**
CHENROLL		.0026	.0029
CHTED		-.0564	-.0223
CHTEXP		-.0608	-.0784
CHTATT		.1596	.1825
CHPTNW		-.0030	.0082
CHPCR		-.0864	-.0755
TITLE1D0		-1.1554	2.0403
TITLE1D1		5.9234	-3.105
TITLE1D2		-1.1899	3.0292
R^2	.092	.067	.159
F-Ratio	20.83**	1.95**	4.53**

* statistically significant at the .05 level
** statistically significant at the .01 level

Table VI

Regression Equations for Estimating the Impact of School Social Context Variables on Changes in Students' Academic Growth Rates

	Model 5.1	Model 5.2	Model 5.3
	Coefficient	Coefficient	Coefficient
Intercept	-.9573	.7644	.1816
PERTRAN		-.8035	-1.1931
SEX		1.5077	1.4791
GRADE 2		-4.0741	-4.8093
GRADE 3		-3.6942	-3.5361
GRADE 4		-4.2143*	-4.6767**
GRADE 5		-3.7818*	-4.2206*
GRADE 6		-5.3697**	-5.7261**
LSUBPAY		1.3570	1.0556
LSUBFREE		.3918	.5966
INITCOMP		.1513**	.1496**
CHSTATT	-.2038		-.2769
CHPSNW	-.0021		-.0954*
CHSMIQ	.0551		-.2119
CHLSUB		.0802	.0439
CHCOMPM		.4363**	.4528**
CHRACE		.0867*	.1519**
CHENROLL		.0007	.0029
CHTED		-.0535	-.0223
CHTEXP		-.0726	-.0784
CHTATT		.1602	.1825
CHPTNW		-.0544	.0082
CHPCR		-.1062	-.0755
TITLE1D0		2.4534	2.0403
TITLE1D1		-1.3631	-3.105
TITLE1D2		3.6207	3.0292
R^2	.003	.148	.159
F-Ratio	.51	4.74**	4.53**

* statistically significant at the .05 level
** statistically significant at the .01 level

Table VII

Regression Equations for Estimating the Impact of School Resource Variables on Changes in Students' Academic Growth Rates

	Model 6.1	Model 6.2	Model 6.3
	Coefficient	Coefficient	Coefficient
Intercept	.6459	-1.2925	.1816
PERTRAN		-1.6641	-1.1931
SEX		1.4258	1.4791
GRADE 2		-4.2875	-4.8093
GRADE 3		-2.4979	-3.5361
GRADE 4		-3.849*	-4.6767**
GRADE 5		-3.2621*	-4.2206*
GRADE 6		-5.6016**	-5.7261**
LSUBPAY		.9382	1.0556
LSUBFREE		.3359	.5966
INITCOMP		.1435**	.1496**
CHSTATT		-.1395	-.2769
CHPSNW		-.1103**	-.0954*
CHSMIQ		-.2527	-.2119
CHLSUB		.0191	.0439
CHCOMPM		.4542**	.4528**
CHRACE		.1490**	.1519**
CHENROLL	.0011		.0029
CHTED	-.0654		-.0223
CHTEXP	-.0783		-.0784
CHTATT	.1872		.1825
CHPTNW	-.0155		.0082
CHPCR	.0109		-.0755
TITLE1D0	-1.0599		2.0403
TITLE1D1	6.0460		-3.105
TITLE1D2	-.4000		3.0292
R^2	.020	.148	.159
F-Ratio	1.38	6.98**	4.53**

* statistically significant at the .05 level
** statistically significant at the .01 level

dent variable is accounted for by the cluster of individual background variables over and above the effects of the other variables in Model 3.3.

Overlap between the cluster of individual background variables and the other three variable clusters can be calculated by adding the squared multiple correlations of Models 3.1 and 3.2 and subtracting the total from Model 3.3. In this case, only .7% of the variance in change in the rate of academic growth can be attributed to covariation between individual background variables and the three other variable clusters.[1]

Examining the predictive power of particular individual background variables, initial composite achievement level (INITCOMP) appears to have the strongest association with the dependent measure. In both Models 3.1 and 3.3 the regression coefficients attached to INITCOMP achieved statistical significance. Likewise the zero-order correlation coefficient between INITCOMP and the criterion was statistically significant (see Table III). The signs on these coefficients indicate that students with higher initial ability levels tend to have more accelerated academic growth patterns than students possessing lower levels of initial ability.

The findings with respect to the impact of students' grade levels on their academic growth rates is difficult to interpret using only the regression results, because many of the dummy variables representing membership in the particular grades are highly correlated with the measure of initial ability level. Hence, one cannot be sure whether the

1. Mood (1971) describes this method of variance partitioning in more detail, while Mayeske (1969) provides an example of this analytical framework.

magnitude of the regression coefficients associated with the variables denoting grade level are due to the relationship between grade level and the criterion or the relationship between grade level and initial ability. An appeal to the zero-order correlations, however, points out the strange finding that sixth-graders do tend to have significantly slower academic growth rates than the other pupils in the sample. This finding, which will be explored more fully in the next section of this chapter, is probably just a function of the sample utilized in this particular study.

Among the individual background variables, many surface as poor predictors of change in the rate of academic growth. There is no evidence linking students' classification as permissive or mandatory transfers (PERTRAN), sex, or level of lunch subsidy (a proxy for socio-economic class) to the dependent measure.

Models 4.1, 4.2, and 4.3 permit an examination of the impact of classroom social context variables, which happen to be the most powerful set of predictors of students' changes in the rate of academic growth. Taking the difference between Models 4.2 and 4.3, it can be discovered that 9.2% of the variance in the dependent variable can be attributed uniquely to the set of three classroom social context variables. In addition, summing Models 4.1 and 4.2 and subtracting the total from Model 4.3 yields the information that 0.0% of the variance in the dependent variable can be attributed to multi-collinearity among the independent variable clusters.

Table V is a source for great optimism, because it reveals that differences in student outcomes can be attributed to changes in students' classroom environments. In short, it provides support for the proposi-

tion that changes in school environments do make a difference.

Within the set of classroom social context indices, change in classroom mean composite achievement level (CHCOMPM) surfaced as a statistically significant predictor of the criterion in both Models 4.1 and 4.3. Moreover, CHCOMPM appears to be primarily responsible for the predictive power of the whole cluster of classroom social context variables. The signs on the coefficients associated with CHCOMPM show that moves into classrooms with higher academic ability levels serve to increase black students' academic growth rates. In contrast, the classroom social context variable measuring changes in the proportion of classmates receiving a free lunch (CHLSUB) possessed a very weak association with the criterion. Another index of classroom social context, changes in the proportion of non-white classmates, appears to have a slight positive relationship with changes in the rate of academic growth, as indicated by the regression coefficients in Models 4.1 and 4.3. However, the relationship between changes in classmates' racial composition and changes in academic growth rates is more complex than it appears here, and will be given more attention in the second section of this chapter.

Table VIII provides a summary of the results of the variance partitioning procedure for all four of the independent variable clusters. It permits a comparison to be made with respect to the predictive power of each cluster of independent variables. Using Table VIII, one can quickly detect that individual background variables (IBV) and classroom social context variables (CSCV) exert the strongest independent influences on student performance, with the CSCV cluster having the strongest association with the dependent measure. In contrast, school resource

variables (SRV) and school social context variables (SSCV) have very weak associations with the dependent variable -- the independent effects of each cluster account for only 1.1% of the variance in the criterion variable.

Insert Table VIII

The weak relationship that exists between variables in the school resource cluster and black students' achievement growth patterns deserves special attention for the reason that levels of school resources are typically used to gauge school quality. Moreover, teacher education, teacher experience, and pupil/classroom ratios are primary determinants of school expenditure levels. The regression coefficients contained in Table VII do exhibit the tendency for black students' academic growth rates to accelerate when their receiving schools have a lower percentage of teachers with less than four years of experience and a lower percentage of teachers without graduate degrees. However, the regression coefficients associated with these variables are not statistically significant in either Model 6.1 or 6.3.

The findings with respect to the impact of changes in pupil/classroom ratios (CHPCR) on changes in academic growth rates are difficult to determine from the information contained in Table VII due to the instability of the regression coefficients associated with CHPCR. But the zero-order correlation of .01 which exists between CHPCR and CRAG (see Table III), clearly reveals that no strong link exists between the two variables.

Among all the variables contained in the school resource cluster, changes in the rate of teacher attendance (CHTATT) appears to be the

Table VIII

Partitioning of Variance Among the Independent Variable Clusters

	Independent Effects	Overlap Effects
Individual Background Variables	3.6%	0.7%
School Social Context Variables	1.1%	-0.8%
Classroom Social Context Variables	9.2%	0.0%
School Resource Variables	1.1%	0.9%

best predictor of the dependent variable. The regression coefficients associated with CHTATT are relatively stable and the zero-order correlation between CHTATT and CRAG is positive and statistically significant ($p \leq .05$, see Table III). These findings indicate that transferring to a school with higher teacher attendance rates probably would have a slight positive impact on achievement growth patterns.

The other school resource variables, changes in school size, changes in the racial composition of teachers, and changes in the availability of Title I programs all have very low correlations with the criterion as well as unstable regression coefficients, which suggests that none of these variables are important determinants of student outcomes.

The effects exerted by the school social context variable cluster, which is comprised of changes in schoolmates' attendance rates, changes in schoolmates' racial composition, and changes in schoolmates' mean IQ, can best be summed up by the negative value of the SSCV overlap reported in Table VIII. On a simple level, this negative value means that school social context variables are better predictors of the dependent variable when used in conjunction with other independent variables than they are alone. A state of affairs such as this one often occurs when a set of variables have relatively low correlations with the criterion, but covary with other predictors which are highly correlated with the criterion. Indeed, Table III shows that the school social context variables have very low correlations with the dependent variable, and generally high correlations with the classroom social context variables which are strong predictors of the criterion. Hence, the set of school social context variables should not be looked upon as important components of the models predicting changes in pupils' academic growth

rates (Kelly et. al., 1969).

One caveat should be mentioned concerning both the school social context and school resource variables. These indices of change were constructed from data gathered at the school level, and therefore might not perfectly represent the characteristics of each individual student's environmental change. With respect to these sets of variables, this study is subject to the same criticisms as many of the earlier studies of school effects, i.e., school level aggregation involves the invalid assumption that all students within a particular school are exposed equally to each resource.

In summary, the regression analysis shows that the two variable clusters composed of indices of changes in classroom social context and measures of individual background characteristics have the most dramatic impact on black students' achievement growth patterns. Conversely, the two variable clusters consisting of indices of changes in school social context and indices of changes in the level of school resources have little impact on changes in the rate of academic growth.

Two variables emerged as having strong positive relationships with the dependent variable -- changes in the level of classmates' academic ability and initial achievement level. Two other variables, changes in classroom racial composition and grade level, appeared to have modest associations with changes in the rate of academic growth. Movement into receiving classrooms with a higher percentage of non-white students than sending classrooms tended to improve black students' academic growth rates, while children enrolled in the sixth grade at the sending school were inclined to have depressed academic growth rates.

Additional Statistical Analyses

This section examines in depth the impact of grade level, initial achievement level, changes in classroom mean achievement, and changes in classroom racial composition on changes in the rate of black students' academic growth. As demonstrated in the previous section, these four variables were the most powerful predictors of the dependent measure. In this section, special attention will be given to determining the unit change in the criterion variable that would occur as the result of various changes in the values of the independent variables.

Table IX contains a summary of an analysis in which the four variables mentioned in the preceding paragraph are employed as the only independent variables (if the dummy variables used to represent grade level in the sending school are counted as one). The table indicates that these four variables as a group account for 11.2% of the variance in the dependent measure, which is nearly as much as the 15.9% of the variance in the criterion that was accounted for by the full regression model reported in the previous section.

Insert Table IX

Displayed in Tables X and XI are mean changes in the rate of academic growth partitioned by grade level. In Table X, where no control variables are entered to adjust these means, no significant trend emerges--a clear case cannot be made that students in either higher or lower grades have different academic growth patterns. When these means are adjusted for the covariation which exists between grade level and three other variables under consideration in this section the same conclusion is still warranted (Table XI).

Although no general pattern surfaces which links black students'

Table IX

Analysis of Variance Using
the Four Variable Model

Source	DF	SS	MS	F
Model	8	7494.75	936.84	9.65**
Error	615	59720.75	97.11	
Total	623			

R^2 = .112

** statistically significant at the .01 level

changes in academic growth rates to enrollment in either early or late grades, several of the means that appear in Tables X and XI are significantly different from each other. Among the most conspicuous differences is the divergence that exists between the means of sixth grade students and seventh grade students, which is visible even when the means are adjusted for the covariates. Because no logical or theoretical explanation exists for a finding such as this one, its presence most probably is a function of the particular sample utilized in this study. Furthermore, even though grade level does not appear to be a systematic determinant of the dependent measure, the representative set of dummy variables will be retained as statistical controls in subsequent analyses to serve as proxies for the forces that are actually responsible for the relationship.

Insert Tables X and XI

The effects of initial academic ability levels on changes in the rate of academic growth can be examined with the use of Tables XII and XIII. The unadjusted means reported in Table XII indicate that pupils with initial achievement levels that exceeded the sample mean experienced improved academic growth rates equalling approximately seven-tenths of a month per year while attending their receiving school. By way of contrast, lower achievers suffered diminished academic growth rates of about one and one half months per year in their receiving schools. The means displayed in Table XIII, which are adjusted for covariates (grade level, change in classroom racial composition, and change in classroom mean achievement), resemble the means contained in Table XII. This confirmation lends support to the finding that higher achieving

Table X

Mean Change in the Rate of Academic Growth by Grade Level in Sending School

	N	Mean CRAG	Standard Error
Grade 2	21	-.90	2.25
Grade 3	54	.17	1.40
Grade 4	174	-.53	.78
Grade 5	156	.97	.83
Grade 6	164	-2.56	.81
Grade 7	55	2.05	1.39

Probability Mean(I) = Mean(J)

	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7
Grade 2	1.00	.69	.88	.44	.49	.26
Grade 3		1.00	.66	.62	.09	.34
Grade 4			1.00	.19	.07	.11
Grade 5				1.00	.002	.50
Grade 6					1.00	.004
Grade 7						1.00

Table XI

Adjusted Mean Change in the Rate
of Academic Growth by Grade Level in Sending School*

	N	Mean CRAG	Standard Error
Grade 2	21	-1.32	2.19
Grade 3	54	-.19	1.37
Grade 4	174	-.91	.76
Grade 5	156	.49	.79
Grade 6	164	-1.53	.78
Grade 7	55	2.02	1.34

Probability Mean(I) = Mean(J)

	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7
Grade 2	1.00	.66	.86	.44	.93	.19
Grade 3		1.00	.64	.67	.40	.25
Grade 4			1.00	.20	.58	.06
Grade 5				1.00	.07	.33
Grade 6					1.00	.02
Grade 7						1.00

* The means are adjusted for initial achievement level, changes in classroom mean achievement, and changes in classroom racial composition.

students tend to have more accelerated academic growth rates than lower achieving students, regardless of the nature of the environmental changes which they experience.

Insert Tables XII and XIII

Tables XIV and XV provide comparisons between a group of students whose receiving classroom achievement mean exceeded their sending classroom achievement mean by at least one grade equivalent and a second group of students whose receiving classroom achievement mean failed to exceed their sending classroom achievement mean by one grade equivalent. Revealed by the unadjusted means displayed in Table XIV is the fact that the average academic growth rate of the latter group decreased by an average of a little over two months per year. Precisely the opposite held true for the former group of students -- their academic growth rates averaged an increase of approximately one and one half months per year. This finding appears to be relatively robust, as the means undergo only minor fluctuations when they are adjusted for the covariates, which in this case are change in classroom racial composition, initial achievement level, and grade level.

Insert Tables XIV and XV

For the group of students whose initial achievement level fell below the sample mean, Table XVI depicts the relationship between changes in classroom mean achievement and changes in academic growth rates. Table XVI indicates that low achievers' academic growth rates suffer dramatically from moves where the mean achievement level in the receiving classroom does not surpass the mean achievement in the sending classroom

Table XII

Mean Change in the Rate of Academic Growth by Initial Achievement Level

	N	Mean CRAG	Standard Error
Initial Achievement Level ≤ Sample Mean	320	-1.46	.58
Initial Achievement Level > Sample Mean	304	.68	.59

Probability Mean(1) = Mean(2): .01

Table XIII

Adjusted Mean Change in the Rate of
Academic Growth by Initial Achievement Level*

	N	Mean CRAG	Standard Error
Initial Achievement Level ≤ Sample Mean	320	-1.14	.72
Initial Achievement Level > Sample Mean	304	.76	.63

Probability Mean(1) = Mean(2): .02

*The means are adjusted for grade level in sending school, changes in classroom mean achievement, and changes in classroom racial composition.

Table XIV

Mean Change in the Rate of Academic
Growth by Level of Change in Classroom Mean Achievement

	N	Mean CRAG	Standard Error
Change in Classroom Mean Achievement ≤ 10 Months	316	-2.23	.58
Change in Classroom Mean Achievement > 10 Months	308	1.44	.58

Probability Mean(1) = Mean(2): .0001

Table XV

Adjusted Mean Change in the Rate of Academic Growth by Level of Change in Classroom Mean Achievement*

	N	Mean CRAG	Standard Error
Change in Classroom Mean Achievement ≤ 10 Months	316	-2.34	.70
Change in Classroom Mean Achievement > 10 Months	308	1.69	.69

Probability Mean(1) = Mean(2): .0001

*The means are adjusted for initial achievement level, grade level in sending school, and changes in classroom racial composition.

by at least ten months. A move of this nature results in a three months per year reduction in academic growth rate for the average low achiever. On the other hand, students with relatively low achievement levels appear to benefit slightly from moves into relatively higher achieving classrooms. Although the impact in this case is much less dramatic, the result is an average increase in academic growth rates of about six-tenths of a month per year.

Insert Table XVI

The direction of the relationship between changes in classroom mean achievement level and student achievement patterns is the same for high achievers as it is for low achievers. Higher achieving students' rates average an improvement of roughly two months per year when their transfer results in an increase of more than ten months in their classmates' mean achievement level. On the other hand, the inverse type of move slows the average academic growth rate of high achievers by about one month per year. Table XVII provides the results.

Insert Table XVII

Tables XVIII and XIX can be used to detect the effects of transferring black students from predominantly black sending classrooms (more than 95% black) into receiving classrooms which are either predominantly black, majority black (between 50% and 95% black), or majority white (less than 50% black). The unadjusted means presented in Table XVIII demonstrate that students beginning in predominantly black classrooms, whose transfer resulted in little change in their classroom racial composition, suffered relatively slight academic growth rate declines.

Table XVI

Mean Change in the Rate of Academic Growth by Level of Change in Classroom Mean Achievement for Low Achieving Students (Below Sample Mean)

	N	Mean CRAG	Standard Error
Change in Classroom Mean Achievement ≤ 10 Months	177	-3.15	.82
Change in Classroom Mean Achievement > 10 Months	143	.63	.91

Probability Mean(1) = Mean(2): .002

Table XVII

Mean Change in the Rate of Academic Growth by Level of Change in Classroom Mean Achievement for High Achieving Students (Above Sample Mean)

	N	Mean CRAG	Standard Error
Change in Classroom Mean Achievement $\leq$ 10 Months	139	-1.06	.80
Change in Classroom Mean Achievement $>$ 10 Months	165	2.16	.73

Probability Mean(1) = Mean(2): .003

Also, pupils moving from predominantly black sending classrooms into majority black receiving classrooms experienced substantially increased academic growth rates; their average achievement gain was almost three months per year higher in the receiving school than in the sending school. In stark contrast, moves from predominantly black to majority white classrooms had a devastating impact on academic growth patterns. A move of this nature resulted in an average decline in academic growth rates of approximately three and one half months per year.

When these means are controlled for the effects of changes in classroom mean achievement, grade level, and initial ability (Table IX), the findings become even more dramatic. A difference of almost one grade equivalent separates the means for the group of students moving into majority black classrooms from the group of students moving into majority white classrooms. Put simply, this finding indicates that pupils with equivalent academic gains in their predominantly black sending classrooms may experience academic gains which differ by almost one grade equivalent if their respective receiving classrooms vary only in terms of racial composition. In addition, when the statistical controls were introduced, the effects of moving from predominantly black sending classrooms to classrooms of similar racial composition turned positive.

Insert Tables XVIII and XIX

In Tables XX and XXI, the moves of black students originating in predominantly black sending classrooms are partitioned into six categories on the basis of the racial composition of the receiving classroom and the change in average classroom achievement level between the sending

Table XVIII

Mean Change in the Rate of Academic Growth by Level of Receiving Classroom Percent Black for Students Transferring from Predominantly Black Classrooms (More Than 95% Black)

	N	Mean CRAG	Standard Error
Receiving Classroom More Than 95% Black (A)	329	-.40	.58
Receiving Classroom Between 50% and 95% Black (B)	81	2.86	1.16
Receiving Classroom Less Than 50% Black (C)	50	-3.48	1.48

Probability Mean(I) = Mean(J)

	A	B	C
A	1.00	.013	.054
B		1.00	.001
C			1.00

Table XIX

Adjusted Mean Change in the Rate of Academic Growth by Level of Receiving Classroom Percent Black for Students Transferring from Predominantly Black Classrooms* (More Than 95% Black)

	N	Mean CRAG	Standard Error
Receiving Classroom More Than 95% Black (A)	329	1.41	.84
Receiving Classroom Between 50% and 95% Black (B)	81	3.86	1.29
Receiving Classroom Less Than 50% Black (C)	50	-6.01	1.42

Probability Mean(I) = Mean(J)

	A	B	C
A	1.00	.061	.001
B		1.00	.001
C			1.00

*The means are adjusted for initial achievement level, grade level in the sending school, and changes in classroom mean achievement.

and receiving classrooms. Table XX reveals that there are two types of moves which exert a positive impact on achievement growth rates. First, moves that resulted in little change in classroom racial composition but an improvement in classmates' mean achievement level of better than one grade equivalent served to accelerate academic growth rates by almost two months on average. In addition, moves into receiving classrooms between 50% and 95% black where the average achievement level exceeded that of sending classrooms by more than one grade equivalent had an even more powerful positive effect. A move of this nature resulted in an enormous improvement in academic growth rates of approximately six months per year. By way of contrast, the other four types of moves contained in Table XX all had a deleterious effect on academic growth rates, especially moves into majority white classrooms that were characterized by relatively small gains in average classroom achievement levels. However, as only sixteen students experienced moves of this nature, it is difficult to draw reliable conclusions from this finding. One interesting change appears in Table XXI, where the means contained in Table XX are adjusted for students' initial achievement level as well as grade level in the sending school. Here, moves into receiving classrooms between 50% and 95% black had a beneficial impact even when these moves did not happen to increase classmates' average achievement level by more than one year.

Insert Tables XX and XXI

Summary

The full set of independent variables included in this study explained approximately 16% of the variance in students' change in the

Table XX

Mean Change in the Rate of Academic Growth by Level of Receiving Classroom Percent Black and Change in Classroom Mean Achievement for Students Transferring from Predominantly Black Classrooms (More Than 95% Black)

	N	Mean CRAG	Standard Error
Receiving Classroom More Than 95% Black and Change in Classroom Mean Achievement $\leq$ 10 Months (A)	217	-1.54	.70
Receiving Classroom More Than 95% Black and Change in Classroom Mean Achievement $>$ 10 Months (B)	112	1.79	.97
Receiving Classroom Between 50% and 95% Black and Change in Classroom Mean Achievement $\leq$ 10 Months (C)	33	-1.45	1.79
Receiving Classroom Between 50% and 95% Black and Change in Classroom Mean Achievement 10 Months $>$ (D)	48	5.81	1.48
Receiving Classroom Less Than 50% Black and Change in Classroom Mean Achievement $\leq$ 10 Months (E)	16	-7.50	2.57
Receiving Classroom Less Than 50% Black and Change in Classroom Mean Achievement $>$ 10 Months (F)	34	-1.59	1.76

Probability Mean(I) = Mean(J)

	A	B	C	D	E	F
A	1.00	.01	.96	.0001	.03	.98
B		1.00	.11	.02	.001	.09
C			1.00	.002	.05	.96
D				1.00	.0001	.001
E					1.00	.06
F						1.00

Table XXI

Adjusted Mean Change in the Rate of Academic Growth by Level of Receiving Classroom Percent Black and Change in Classroom Mean Achievement for Students Transferring from Predominantly Black Classrooms (More Than 95% Black)*

	N	Mean CRAG	Standard Error
Receiving Classroom More Than 95% Black and Change in Classroom Mean Achievement ≤ 10 Months (A)	217	-.46	.95
Receiving Classroom More Than 95% Black and Change in Classroom Mean Achievement > 10 Months (B)	112	2.17	1.13
Receiving Classroom Between 50% and 95% Black and Change in Classroom Mean Achievement ≤ 10 Months (C)	33	.98	1.86
Receiving Classroom Between 50% and 95% Black and Change in Classroom Mean Achievement > 10 Months (D)	48	7.28	1.66
Receiving Classroom Less Than 50% Black and Change in Classroom Mean Achievement ≤ 10 Months (E)	16	-8.00	2.50
Receiving Classroom Less Than 50% Black and Change in Classroom Mean Achievement > 10 Months (F)	34	-1.80	1.71

Probability Mean(I) = Mean(J)

	A	B	C	D	E	F
A	1.00	.03	.45	.0001	.004	.49
B		1.00	.56	.005	.0002	.05
C			1.00	.007	.004	.27
D				1.00	.0001	.0001
E					1.00	.04
F						1.00

*The means are adjusted for initial achievement level and grade level in the sending school.

rate of academic growth. Two particular clusters of independent variables emerged as important determinants of the dependent measure, these being individual background characteristics and aspects of changes in classroom social context. More specifically, 3.8% of the variance in students' change in the rate of academic growth could be attributed uniquely to the set of individual background variables, while 9.2% of the variance in the dependent measure was accounted for solely by changes in classroom social context. A total of four independent variables, two contained within each of the two clusters mentioned above, surfaced as the most powerful predictors of the dependent measure--grade level in the sending school, initial achievement level, changes in classroom racial composition, and changes in classmates' average achievement level. The findings with the greatest implications for educational policymakers were that increases in classroom mean achievement levels which resulted from black students' relocation to a new school had a positive impact on academic growth patterns, and that black students originating in predominantly black sending classrooms suffer academically from moves into majority white receiving classrooms. Moreover, the most beneficial type of move for a black student attending a segregated sending classroom was identified to be one in which the receiving classroom was between 50% and 95% black and had a relatively higher level of academic performance than the sending classroom.

Chapter 5

CONCLUSIONS AND POLICY RECOMMENDATIONS

This chapter is composed of four sections. It begins with a summary of the major findings. The second section is a discussion of the limitations that must be considered before applying the research findings to policy decisions. The third part of this chapter contains various policy recommendations which follow from the research. The chapter concludes with a discussion of some implications for future school effects research.

Summary of the Findings

Court-ordered desegregation, voluntary desegregation programs, school utilization problems, and realignment of attendance areas to accomodate the changing residential patterns of students make the transfer of students from one school to another a common occurrence in modern urban schools. The purpose of this study was to provide information which might be helpful in assigning pupils to new classrooms. In particular, the objective of the research was to determine how pupil relocation policies might be used to improve the academic achievement of black students at the same time that relocation takes place.

Data covering three years were collected on a sample of 624 black students attending the St. Louis Public Elementary Schools who were transferred from one school to another as the result of administrative decisions. One part of the sample was composed of students who were labelled: "transported for overcrowding at the home school". Another part consisted of students who changed schools as the result of permissive transfers, which are transfers requested by parents and granted by the St. Louis Board of Education only if they result in the reduction of

racial isolation at both the sending and receiving schools.

The method used to determine the effects of changing school environments was to compare each student's academic gain (or growth rate) in the year prior to relocation with their academic gain in the year following relocation, and subsequently to detect whether certain types of moves were associated with changes in academic growth rates. Hence, the findings of this study only describe the effects of environmental changes that accompany relocation to a new school rather than the effects of changes in educational settings that students might experience while attending a single school.

Following is a summary of the major research findings:

1) Increases in classroom mean achievement levels have a substantial positive impact on black students' academic growth patterns. When the effects of grade level, initial achievement level, and changes in classroom racial composition were controlled, moves in which the average achievement level of the receiving classroom exceeded that of the sending classroom by more than one grade equivalent were associated with an improvement in academic growth rates of almost two months per school year. This means that students' academic gains in their receiving classrooms tended to be two-tenths of a grade equivalent greater than what would have been expected given their achievement gains in their sending classrooms. Conversely, moves that resulted in gains of less than one grade equivalent in classmates' mean achievement level tended to slow academic growth rates by a little more than two months per school year.

Here, it is important to note that a change of approximately one grade equivalent (or 10 months) in classmates' mean achievement level is the normal expectation, because classmates are a grade older in the

receiving school than in the sending school. Therefore, when the average achievement level of the receiving classroom exceeds that of the sending classroom by more than one grade equivalent, the receiving classroom can be described as having a relatively high level of academic performance compared to the sending classroom.

2) In the presence of statistical controls for grade level, initial achievement level, and changes in peers' mean achievement level, students originating in predominantly black sending classrooms (95% or more black) benefit academically from moves into majority black classrooms (between 50% and 95% black), but suffer from moves into majority white classrooms (less than 50% black). The former type of move improved academic growth rates by almost four months per school year, while the latter type of move depressed academic growth rates by six months per school year. In addition, the effects of moving from predominantly black sending classrooms to classrooms of similar racial composition appeared to have a moderately positive effect. A move of this nature on average resulted in an academic gain in the receiving school that exceeded the academic gain in the sending school by a little more than a month.

3) When the effects of changes in classroom racial composition and changes in classmates' average achievement level were examined in conjunction with each other, one of the most powerful findings of the research emerged -- the optimal type of move for a black student originating in a predominantly black classroom was found to be one in which the receiving classroom was between 50% and 95% black and could be characterized as having a relatively higher level of academic performance than the sending classroom. A move of this nature was associated with

an average increase in students' academic growth rates of seven months when comparing students' academic gains prior to their move with their academic gains following relocation.

4) Relatively high achieving students tend to experience larger academic gains in their receiving schools than in their sending schools, while low achievers tend to experience depressed achievement gains in their receiving schools.

5) Changes in the characteristics of school environments that can be directly purchased, including pupil/classroom ratios, level of teachers' education, and level of teachers' experience, do not appear to be strongly related to the academic growth rates of black students in this study. However, the data upon which this conclusion is based were gathered at the school level, which probably resulted in an underestimation of the effects of this set of indices. Hence, no precise statement with respect to this set of school inputs can be made.

In their most general form, the findings of this research lend support to the notion that pupils' educational experiences are significant determinants of their academic outcomes. From this broad perspective, the prevailing tendency associated with the results of longitudinal regression studies of school effects has been substantiated. However, a more detailed comparison between the results of this study and the results of other studies based on longitudinal regression approaches would be misleading because a totally different set of school effects were examined. This particular study focused upon the effects of changes in school environments that come as a result of relocation to a new school. Other longitudinal regression studies, while attempting to ascertain the determinants of achievement gains, simply focus upon the effects of

exposure to different levels of school characteristics. Only one independent variable included in the entire set of previous studies is constructed as an index of change, and that is Winkler's measure of changes in school racial composition between students' elementary school and junior high school. Interestingly, his finding with respect to changes in school racial composition is confirmed by the findings of this study -- large increases in the proportion of white classmates have a deleterious effect on black achievement.

Limitations of the Research

The following section begins with a description of several limitations which characterize large scale studies of school effects in general and this research in particular. Subsequently, some limitations which are unique to this investigation are discussed.

In examining the more general caveats associated with interpreting the results of this research, perhaps the exclusive reliance on achievement test data to represent educational outcomes should be considered first. To be sure, there are goals of schooling other than the promotion of academic performance that merit attention. St. John (1975) captures this point in a critique of past research on school desegregation:

> The narrow emphasis of most desegregation research on cognitive outcomes should also be expanded... Ways of measuring many other potential outcomes of schooling -- leadership, human sensitivity, understanding of one's own cultural heritage, effective public speaking, and so forth -- might be found. Racial conflict develops in many desegregated schools. Does such conflict have positive or negative effects? Does it lead to growth of a healthy degree of militancy, political skill, self-confidence, or to a growth of unhealthy distrust, prejudice, and anomie? (p. 123)

Reliance on achievement tests also might be questioned for another reason. Probably the most widely argued criticism of standardized

testing surrounds the issue of sampling bias. Put simply, sampling bias occurs when a test is normed or standardized on one population and then used to evaluate the performance of individuals from a different population. Applying the concept of sampling bias to this research in particular, it might be hypothesized that utilization of the Iowa Test of Basic Skills, which essentially reflects the norms of white middle class students, may not adequately represent the true achievement level of the typically low socio-economic status black students residing in the St. Louis Public Schools.

Another caveat stems from an omission of many of the aspects of students' school environments from the statistical analysis contained in this research. For example, the measures of teacher characteristics used in this study do not include variables of a psychological nature such as personality and teaching style, and no measures to account for how students are actually spending their time in school are included in this investigation. As a consequence of these omissions, one can only speculate about what theoretical frameworks underlie the research findings.

Finally, a methodological issue deserves some attention. Because this research was not conducted as a controlled experiment, it was not possible to systematically manipulate levels of school characteristics one at a time while holding all other school characteristics constant in an effort to assess the impact of changes in specific school factors on students' academic growth rates. As a substitute, statistical techniques had to be used to detect what types of changes in school environments are associated with accelerated rates of achievement growth. Hence, causal inferences derived from this research are somewhat tenuous.

Shifting attention from the general limitations of school effects research, four limitations more particular to this investigation are important to address. Three of these limitations are linked directly to the nature of the sample utilized in this study and can be characterized as threats to the generalizability of the research results, while the fourth involves the relatively short duration of time for which data were gathered.

First, the sample contains only 624 students. This relatively small sample size raises the possibility that the research findings might not be perfectly replicated in a similar study utilizing a different sample of students.

Second, the sample is composed only of black students in the St. Louis Public Elementary Schools. Because the sample contains students concentrated in a single geographic location, questions must be posed concerning the population to which the research results can be generalized. It is unclear whether the findings of this study are applicable to black children residing in every urban school system.

Third, the students included in this study were not part of a comprehensive court-ordered desegregation program, rather they were transferred primarily as the result of relatively small scale administrative decisions related to overcrowding and school closings. Hence, the widespread political conflict which typically accompanies broad school desegregation programs was not experienced. Because intense political conflict in the surrounding community may have an impact on pupil performance in the receiving school, questions must be raised as to whether the findings of this research are applicable to school systems

in the midst of implementing massive pupil relocation programs.

Finally, one other limitation of this study is important to note. In this research, pupils' academic progress was monitored for only one year before and after their relocation to a new school. As a result of this relatively short time span, this study necessarily examined the short-term effects of changing school environments, which may be quite different from the longer term effects.

Although the factors mentioned in the previous pages suggest that some caution should be taken when translating the results of this study into policy recommendations, several reasons exist why this research can supply useful information to higher level local, State, and Federal policymakers who control the allocation of purchasable school resources and formulate student assignment policies. To begin, even though it is important to consider outcomes of schooling other than academic performance in any research directed at assessing the potential impact of different educational policy decisions on minority students, studies like this one which focus exclusively on student achievement still appear to be of considerable use. The growth of the minimum competency testing movement underscores assigning a high priority to student achievement as an outcome of schooling. Another justification for concentrating on student achievement arises from research which links levels of cognitive ability to future income and occupational levels. One of the most convincing studies in this area was conducted by Hansen, Weisbrod, and Scanlon (1970). It focused on the relationship between cognitive achievement and earnings in a group of low achievers. Utilizing a sample of 2,400 young men who were rejected from military service because they failed the Armed Forces Qualification Test (AFQT), these researchers found that AFQT scores were an important

determinant of subjects' current income levels.

Challenges to the validity of standardized test scores also must be taken seriously, however it appears that ample meaning can be attributed to these scores. At an absurd minimum, scoring well on a standardized test measures one's ability to test well, which has become an increasingly important skill in today's society. In addition, high test scores probably indicate a motivation on the part of the student to perform well, which actually may be as important as what the student really knows. Moreover, achievement tests measure skills or qualities which are deemed important by future employers, which is probably why these test scores are correlated with post-school attainment.

Because this research was conducted for the purpose of informing school policymakers about what school factors exert an influence on the academic growth patterns of minority students, it concentrated on characteristics of school environments which are conducive to change. For this reason, the inclusion of variables of a psychological nature is sacrificed and attention is fixed on the allocation of purchasable school resources and those characteristics of schools which can be controlled by pupil relocation programs.

An additional reason for educational policymakers to consider the results of this study is that many of the methodological problems which have flawed earlier analyses of educational effects are either minimized or eliminated in this research. Particularly, the data utilized in this study include longitudinal information on individual students and individual classrooms and the data cover a group of students who actually changed schools as the result of educational

policy decisions. Therefore, this study was not restricted by data problems which typically have impinged upon the quality of the research designs used in previous school effects investigations. It follows that the presence or absence of relationships between school factors and student outcomes demonstrated by this research cannot be readily attributed to an invalid research design.

Policy Recommendations

At a very basic level, the most important contribution this research can make to school policymakers is to refute the notion that black students' educational experiences have little impact on their academic performance patterns. This research has clearly demonstrated that changes in the characteristics of school environments do play an important role in the determination of black students' academic outcomes, which suggests that if educational settings are manipulated correctly the strong link which exists between students' individual backgrounds and their academic performance can be severed. Reducing the dependence of pupils' ability levels on their family backgrounds is at the heart of equalizing educational opportunities, therefore schools must be afforded the consideration necessary to accomplish this important task.

The findings of this research also have broad implications for school officials charged with the responsibility of formulating pupil assignment strategies. Because different types of moves do have dramatically different effects on student achievement patterns, school officials should take into consideration the educational quality of school desegregation plans along with the more common concerns pertaining to constitutional compliance, political feasibility, and economic viability. To be sure, the satisfaction of court orders, the mitigation of community

conflict, and the easing of financial strain are important aspects of pupil relocation programs, but to subordinate the potential academic returns which might accrue to various pupil reassignment strategies is to do students a great misservice.

On a much more specific level, the findings of this research can aid school policymakers in formulating the details of school desegregation plans. The most policy relevant findings of this study were that increases in the ability levels of black students' classmates resulted in accelerated academic growth rates, and that moves originating in predominantly black classrooms and ending in less segregated but still majority black classrooms tend to have a positive impact on black students' achievement patterns. On the contrary, the opposite holds true for moves originating in predominantly black classrooms and ending in majority white classrooms; moves of this nature have a deleterious academic effect on black achievement. In summary, the findings indicate that the optimal type of move involves a moderate increase in the proportion of white classmates as well as an increase in the average ability level of the classroom.

These findings suggest that school administrators take into account both changes in classroom achievement levels and changes in classroom racial composition when formulating pupil assignment strategies so that students would be transferred between schools in a way which maximizes their academic performance. For this to occur, the initial steps which must be taken are for school districts to regularly collect comprehensive racial composition and achievement data and to create a data management system which can manipulate these data with facility.

The optimal type of move discussed earlier in this section appears to be the dominant occurrence in most of the urban intra-district desegregation programs. The typical policy in urban school desegregation plans is to transfer students between schools so that the racial composition of each individual school mirrors that of the entire district. And as black students compose the majority in many urban school districts, transfers from predominantly black schools usually result in relatively moderate changes in classroom racial composition. Moreover, as white students tend to achieve at higher levels than black students, these moves probably also result in increases in classmates' ability levels.

Because intra-district desegregation plans in many urban school districts would lead to a school system characterized by majority black schools, it is common to suggest that a cautious or gradual approach to intra-district school desegregation be undertaken -- one which seeks to avoid white flight and concomitant resegregation. In addition, fears of white flight often generate pressure for metropolitan remedies for school segregation. Here, the argument is that there would be little incentive for white families to flee the inner-city in order to dodge participation in school desegregation plans. However, the findings of this research bring into question the academic significance of white flight and its use to justify metropolitan desegregation strategies. Because black students in this sample appear to perform best in majority black classrooms, white flight may not have a deleterious impact on black academic performance. Finally, the research findings suggest that metropolitan solutions to school desegregation which would result in black students becoming a minority within a white majority should

be approached with a great deal of caution.

Implications for Future Research

The general finding of this research is that differences in black students' academic outcomes can be attributed to school factors under the control of school policymakers. This confirms the trend of discoveries generated by longitudinal regression studies of school effects. Although the particular characteristics of school environments which emerge as significant predictors of student achievement patterns are not uniform across longitudinal studies of school effects, the prevailing feeling that schools can and do make a difference is consistent. This pattern is in marked contrast to that associated with earlier cross-sectional school effects studies, where the main concern among school effects researchers was simply to ascertain whether schools made a difference or not (e.g. Coleman v. Jencks (1972)). The reason for this transformation appears to be clear -- more sensitive methodologies were needed to demonstrate school effects. This section provides some methodologically oriented suggestions which would serve to enhance the ability of future school effects researchers to inform educational policyamkers.

Perhaps the most important of these recommendations is that research should be based on longitudinal data. Both educational inputs and student outcomes should be followed over time, so that it is possible for researchers to establish the associations between changes in students' school environment and changes in their academic performance patterns. Because change is the inevitable result of implementing a new policy, it is the study of change that speaks most directly to educational policymakers.

Another methodological element that should be incorporated into future input-output studies of school effects concerns the use of individual students as the unit of statistical analysis. Put more simply, statistical models should be used to explain the variance in academic outcomes which exists between individual students rather than the variance in academic performance that exists between schools or classrooms. The importance of using individual students as the unit of statistical analysis stems primarily from the fact that differences between individual students are much greater than differences between schools and classrooms. Hence, researchers can better identify for policymakers the aspects of school environments that are associated with differences in students' achievement patterns.

In addition, researchers should formulate strategies which minimize the covariation between measures of individual background characteristics and measures of characteristics of school environments. As mentioned in the second chapter, a high degree of collinearity among these two sets of variables causes the independent effects of school characteristics to be underestimated, which yields the false impression that school environments are not important determinants of academic outcomes.

Finally, input-output school effects researchers should attempt to expand the set of variables used in their analyses. Statistical models might be expanded to include variables that serve to explain the psychological processes which underlie educational effects. For example, McDill, Rigsby and Meyer (1969) incorporated measures of dimensions of school climates in their study. Some of their measures of school social context were labelled Academic Emulation and

Academically Oriented Status System. The use of additional output measures would also serve to increase the power of future input-output research. If the aspects of educational environments which are found to be consistently associated with student achievement are also found to be associated with such things as low levels of student alienation and high levels of student satisfaction, then a much stronger case for instituting various types of educational reforms could be presented to policymakers.

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